§32. Analysis of Helical Plasmas by Use of Distributed Parallel PC Cluster and Its Application to LHD

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In order to study the high dimensional real space-velocity space distributions, various theoretical progresses have been demonstrated. For instance, the heating profile and heating efficiency have been calculated for the analysis of LHD heating experiments. Study of complicated particle orbit has also given a guide line of experiments to demonstrate the suppression of neoclassical transport. In order to cope these theoretical, simulational and computational studied in improving the performance of LHD plasmas, rapid computation of large numerical codes are necessary. In addition, there are many physics processes that influence the plasma confinement. Particle orbit, MHD stability, evolution of global mode, high energy particle heating, rf wave physics, turbulence, turbulence driven transport, etc. Each of important physics processes are investigated by the researchers over Japan (and world). Therefore the method of unifying these studies os elementary processes is also urgent.

In order to introduce the recent theoretical progresses and to unify the studies in various institutions, a joint project of "Analysis of Helical Plasmas by use of Distributed Parallel PC Cluster" was initiated. This is a project to establish a grid computing by use of distributed parallel PC clusters.

One characteristic feature of this programme is that distributed parallel PC clusters are made based on PPCG4 (Kyoto University), Xeon (RIAM Kyushu University) and Alpha (NIFS), and they will be connected via super SINET. The scope includes an analysis of the LHD data from remote clusters, and execution of simulation code which was established by one cluster at remote clusters.

Figure 1 illustrates example of the structure: the system based on Xeon at RIAM Kyushu University. The result of a Himeno Benchmark is shown in table 1. High performance is achieved by this system.

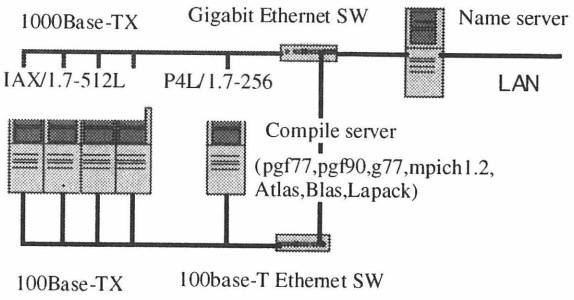

Fig.1 Structure of a cluster. Example at Kyushu Univ. is illustrated.

CPU	Pentium 4 (1.7 GHz)	Pentium II (400 MHz)	Alpha 21264 (700MHz)	SX-5 8GFLOPS (250MHz)*	PPCG4 (667MHz)	ES40 (667MHz)	VPP5000
1	593			5166	95.0	201	4173
2	1112	123	273		201.7	334	8235
4	1936	227	522		383.4	676	15668
8	2608	423					22157

Table 1 Result of Himeno-Benchmark http://w3cic.riken.go.jp/HPC/HimenoBMT/